Integrating Technology Development and Market Systems

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Domestic and International Markets, October 1997: Finance for Environmental Technology and Commercialization

Key Quotes From Market Leaders

"Markets don't buy products, customers do." Tom Peters, Author, *Thriving on Chaos; In Search of Excellence*, Summer 1993

"Customers don't buy technology; they buy solutions. And in the environmental industry, they don't want to buy your product unless they have to." John Schofield, President, Thermatrix (air pollution control company), April 1994

"I would rather return punts in the Canadian Football League than do an environmental deal; there is no exit." Venture Capitalist, Los Angeles, Venture Forum, March 1995

"There is no market when you venture overseas...only finance. Whoever controls finance, controls sales into the market." Albert Angulo, Director, Latin America, U.S. Trade Development Agency, September 1996

"More capital is available now than ever before in the history of mankind." *Barrons' Market Observer*, Summer 1997

Sources of Information: Domestic Markets

Customers remain the **best source** of market information: But, environmental technology companies spend too much time tweaking technology and not enough time at customer sites.

Conventional Sources:

- Trade Publications (e.g., EBJ, ES&T, PE, ENR) and conferences
- *Commerce Business Daily* (if it's in *CBD*, though it may be too late)
- Industry Associations (problem holders): API, CMA, HWAC, EPRI, NEI
- SEC: financial filings that summarize future environmental liabilities
- Regulatory Rulings: NPDES, state agency enforcements, Superfund PRPs
- Law Firms with clients facing enforcement actions or real estate transactions

Newer Sources:

- "Brownfields" agencies at local and state levels
- Finance agencies active in environmental projects (TDA, IFC, IDB, banks)
- User Consortia (e.g., RTDF, CP-5 Reactor Decommissioning Group)
- Private "Extranets" (internet linkages between like-minded users)
- Real Estate Investment Trusts...now with $120 billion in capital
- Web Sites, GNET, Earth Vision

Environmental Industry Developments, 1996-1997

Bad News:

- Superfund continues in limbo; uncertainty freezes remediation spending.
- Enforcement spending and government shutdown curtailed project activity.
- Engineering firms delay experimentation with technologies to reduce risk.
- Budget cutbacks on DOD, DOE programs reversed momentum.
- Large manufacturers shifted to pollution versus prevention remediation.
- Stock market and venture funding collapsed for environmental technology.

Good News:

- More voluntary cleanups moving some work ahead at industrial sites.
- Advent of "Brownfields" is refueling urban site conversion.
- Regulators working more effectively with problem holders.
- Increasing acceptance of some technologies; e.g., field analytics.
- Capital becomes available for site conversion deals, "asset plays."
- Insurance industry projects a significant rise in cleanup costs after 2000: $106 to $125 billion over the next 40 years.
- Interstate regulatory mechanisms aid regional market formation: IRRC, SSEB, MOU efforts by states help adoption of innovative technology.

Environmental Industry Segments by Media, 1994 (in $ millions)

(Source: Environmental Business International, Inc., San Diego, CA, April/May 1995)

Business Segment	Air	Water Wastewater	Hazardous Wastes	Remediation	Solid Waste	Multimedia Other	Total
Services							
Analytical Services	80	380	340	600	140	60	1,600
Wastewater Treatment Works		25,700					25,700
Solid Waste Management					31,000		31,000
Hazardous Waste Management			6,400				6,400
Remediation/Industrial Services				8,600			8,600
Consulting & Engineering	1,450	3,380	3,630	3,580	1,110	2,150	15,300
Subtotal Services:	**1,530**	**29,460**	**10,370**	**12,780**	**32,250**	**2,210**	**88,600**
Equipment							
Water Equipment and Chemicals		13,500					13,500
Instruments and Information Systems	680	840	560	530	40	260	2,900
Air Pollution Control Equipment	11,700						11,700
Waste Management Equipment			3,140	1,100	6,960		11,200
Process and Prevention Technology						800	800
Subtotal Equipment:	**12,380**	**14,340**	**3,700**	**1,630**	**7,000**	**1,060**	**40,100**
Resources							
Water Utilities		24,200					24,200
Resource Recovery			460		14,940		15,400
Environmental Energy Sources						2,200	2,200
Subtotal Resources	**0**	**24,200**	**460**	**0**	**14,940**	**2,200**	**41,800**
Total All Segments:	**13,900 8.2%**	**68,000 39.9%**	**14,500 8.5%**	**14,400 8.5%**	**54,200 31.8%**	**5,500 3.2%**	**170,400**

Remediation Spending by Work Phase, 1992-1996

(Based on annual surveys of remediation contractors by Environmental Business International)

Remedial construction continues to build as a proportion of total spending.
Site assessment spending has dropped by 50 percent as sites move toward cleanup.
Remediation spending has shifted markedly from assessment to actual remedial action.
However, increasing emphasis on risk analysis will boost some assessment spending.

	1992	**1994**	**1996**
Site Assessment and RI/FS	2,275 (35%)	1,303 (20%)	1,063 (17%)
Remedial Design	1,105 (17%)	1,150 (18%)	989 (16%)
Remedial Construction	2,665 (41%)	3,456 (53%)	3,689 (60%)
Closure and Monitoring	455 (7%)	557 (9%)	439 (7%)
Total Spending ($ millions)	**$6,560 (100%)**	**$6,466 (100%)**	**$6,180 (100%)**

13 Big States Comprise Almost Two-Thirds of Market

Environmental employment and revenues are closely correlated with population.

Decline (-)	**Superfund Sites**	**Environmental Revenues ($ billions)**		**Environmental Employs (000s)**		**Environmental Companies**	
State	**1996**	**1996**	**1994**	**1996**	**1994**	**1996**	**1994**
CA (-)	96	22.4	22.0	158.3	160.0	12,464	16,140
TX*	27	14.7	13.1	107.7	98.7	8,087	6,610
NY (-)	79	11.9	13.0	84.6	95.5	6,590	6,390
PA	103	9.2	8.4	67.5	63.6	6,243	4,950
FL* (-)	53	8.8	9.4	61.3	68.0	5,136	5,150
OH	38	7.7	7.5	56.6	56.1	5,096	4,200
NJ (-)	107	7.5	7.7	56.1	59.2	3,920	4,400
IL	38	7.2	6.8	51.3	49.2	5,998	4,770
MI	75	6.9	6.8	50.4	51.5	4,045	3,460
MA (-)	30	4.4	4.4	31.7	32.7	2,775	3,205
NC*	23	4.3	3.8	31.3	28.6	2,605	2,160
GA*	14	4.0	3.8	28.4	27.4	2,470	2,312
VA* (-)	25	3.9	3.9	27.8	26.2	2,614	2,618
Top 13	**708**	**112.9**	**110.6**	**813.0**	**816.7**	**68,043**	**66,365**
% Total	55%	63%	65%	63%	65%	59%	65%
All 50	**1,276**	**178.3**	**170.0**	**1,287.3**	**1,263.0**	**115,400**	**102,700**

* SSEB

Interstate Regulatory Mechanisms

Regulatory cooperation is a pivotal element for cost-effective technology deployment.

Interstate Technology and Regulatory Committee

- 27 states based on voluntary participation; outgrowth of WGA - DOIT.
- Funded mostly by DOE since 1995 ($3 million/year for travel, contract support).
- Focus: Primarily on regulatory mechanisms for remediation technologies.
- Value: Broad-based group built on trust between state regulators.
- Offers valuable lessons-learned and technology/permitting exchange for regulators.

MOU

- Six big states (CA, IL, NY, NJ, PA, MA) all active in environmental technology.
- Exclusive participation; no other states allowed to sign MOU.
- Focus: Exchange across all environmental media — air, water, hazardous waste.
- Value: Covers about 30 percent of environmental market with 6 states.

Southern States Energy Board (SSEB) — PLUS Program

- SSEB organized in 1960 to handle Southern regional environmental/energy issues.
- 16 Southern states, plus PR, VI; 40 percent of U.S. economy.
- Stronger buy-in from governors, state legislators with formal resolution.
- Focus: Utilizes three-tiered process for multi-state regulatory streamlining.
- Value: More cohesive regional cooperation with high-level buy-in.
- Also very involved in radioactive waste transportation planning with states.

Western Governors Association — DOIT Committee

Commercialization Roundtable, August 1993

Ratings of Major Issues on Environmental Technology

A budget of 10 votes for each person; up to 5 votes on a single issue.
Budgeted voting tends to heighten the intensity of participants rating key issues.
Roundtable meeting with technology developers, investors, engineering firms, regulators, and agencies.

Rank	Score	Issue
1	35	Clear procurement path is site demo is successful
2	22	Independent report on performance data and costs
3	17	Integrated permitting (state/federal, cross-media)
4	16	Waiver of cleanup liability for demo
5	14	Well-defined performance criteria (vs. BDAT)
6	12	Preservation of company intellectual property
7	10	Funding or partial funding (cost-share) of demo — one group rated Funding high

___ Other Issue: Government not sensitive to more rapid commercial time cycle.

Federal Agency Versus Industry Customer Priorities on Environmental Management Approaches

	Lower Priority to Agencies	Higher Priority to Agencies
	Industry Focus	**Joint Challenges**
Higher Priority to Industry	• Air pollution control • Wastewater treatment • Water reuse • MGP sites (coal tar, PCBs) • Waste minimization • Solvent, CFC substitution • System reengineering • Real-time process control • Internal audits, ISO 14000	• Highly toxic compounds (PCBs) • Materials recycling • Spent nuclear fuel and rad waste • Integrated in-situ treatments • Expedited site characterization • In-situ bioremediation • Separations technologies — metals; aqueous streams • "Brownfields;" Risk-based cleanups
	Conventional Areas	**Agency Focus**
Lower Priority to Industry	• Hydrocarbon treatment • Soil vapor extraction • Containment • "Dig and haul" • Pump and treat • Thermal desorption	• Rads in soils/groundwater • Incineration/plasma treatment • Unexploded ordinance • High level rad waste tanks • Non-thermal treatments • Vitrification

Financial Disclosure Trends for Environmental Mange

(Price Waterhouse Survey, 1994: survey of 1,300 industrial companies in U.S.; 445 responsed, with two-thirds having greater than $500 million in sales)

★ SEC issues Environmental Disclosure Guidance (SAB 92) in June 1993.

★ ISO 14000 continues to push environmentally sound audit and industrial practices; pollution control and prevention practices trickle down via purchasing decisions.

★ Environmental Disclosures continue to expand for major manufacturers:
- 63% has written internal guidelines on environmental costs versus 11% in 1990.
- 73% now practice environmental audits versus just 40% in 1992.
- More companies are recording environmental liabilities earlier; more in notes.

- ⋆ Recording estimated remediation costs remains complex (under FAS 5); liability disclosure occurs when "probable" **and** "reasonably estimated."

- ⋆ Several factors affect "Reasonable Estimate" of remediation liability (rated 8-1).
  - (7.1) Nature of the site (contaminants, geology, industrial practice, etc.).
  - (6.0) Uncertainty of remediation methods/technology (e.g., extent of removal).
  - (5.2) Extent of regulatory requirements and changes.
  - (3.9) Involvement of other parties/other PRPs.
  - (2.3) Public awareness and community concerns.
  - (2.0) Potential insurance coverage for cleanup.

Investor Views Now Drive Environmental Markets...

What do they look for in Markets and Management?

Investors Look For:	**Seen in Environmental Markets**
• High sales growth market niche: > 20% per year, preferably 50%	Remediation markets seen as slow, stagnant
• Sustainable market share in smaller niche: > 25% is critical to sustain margins and defend competitive position	Most niches lack a standard-bearer, except in water, solid waste
• Competitive advantage: Twice the performance at half the price of current technology	Technology not highly valued generally versus proven approaches
• Clear first customers: If lead customers buy the solutions, others follow	Regulators have big impact on customer decisions
• Defined distribution: Capable field/customer service for repeat business	Environmental technology lacks distribution channels
• Experienced management: A track record in growth markets, making profits	Too many engineers in management; conservative, ill-versed in finance

U.S. Share of Global Environmental Markets

Industry Segments ($ billions)	U.S. 1994	U.S. 1996	World 1996	U.S. % 1996
Environmental Services (S)	**$88.6**	**$93.7**	**$231.1**	**41%**
Solid Waste Management	31.0	33.6	97.1	35%
Wastewater Treatment Works	25.7	28.5	68.3	42%
Consulting & Engineering	15.3	15.5	28.6	54%
Remediation & Industrial Services	8.6	8.6	15.6	55%
Hazardous Waste Management	6.4	6.0	18.0	33%
Analytical Services & Laboratories	1.6	1.5	3.4	44%
Equipment and Technology (T)	**$42.2**	**$45.6**	**$102.2**	**45%**
Water Equipment/Treatment	15.6	17.4	38.1	46%
Waste Management Equipment	11.2	11.8	28.3	42%
Air Pollution Control & Monitoring	11.7	12.2	28.2	43%
Instruments & Info Systems	2.9	3.2	5.3	60%
Process & Prevention Technology	0.8	1.0	2.4	42%
Resources (R)	**$41.8**	**$46.8**	**$114.4**	**41%**
Water Utilities (30,000 entities)	24.2	26.3	71.4	37%
Resource Recovery & Recycling	15.4	18.0	38.1	47%
Alternative Energy	2.2	2.5	4.9	51%
Total Market ($ billions)	**$172.6**	**$183.8**	**$447.7**	**41%**

Multilateral Agencies and Latin America

Primary Financing Sources ($ millions)	FY 95	% Latin America
International Finance Corp. (direct finance portion)	$3,242	38.8%
Syndicated volume as lead project financing agency	$8,118	44.7%
IDB: Inter-American Development Bank - infrastructure finance to public sector entities	$4,800	89.7%
OPIC: Overseas Private Investment Corp. - private sector equity finance and credit insurance	$2,000	30.0%
EX-IM: Export - Import Bank - structured for financing U.S. equipment exports	$1,600	37.5%
MIGA: Multilateral Investment Guarantee Agency - insurance on foreign direct investment	$2,200	40.5%
AID: Agency for International Development - development project lending to governments	$7,000	14.3%
TDA: Trade Development Agency	$ 58	17.2%

Value-Added Drivers Differ in Emerging Markets

Capturing value-added requires adapting different approaches in Asia and Latin America than in the U.S. and Europe; need to analyze "pockets" in value chain in RDCs versus OECD.

"Over" Developed Countries/OECD	Rapidly Developing Countries
Zero population growth	Population doubling again in our lifetime
Slower economic growth (1-3% per year)	Faster economic growth (5-7% per year)
High labor costs	Low labor costs
High value on technology	High value on capital
Centralized, high volume technology	Decentralized, compact technology
Advanced processing efficiency	Undercapitalized producers
Economic-driven practices	Culturally driven traditions
Market-driven	Relationship-driven

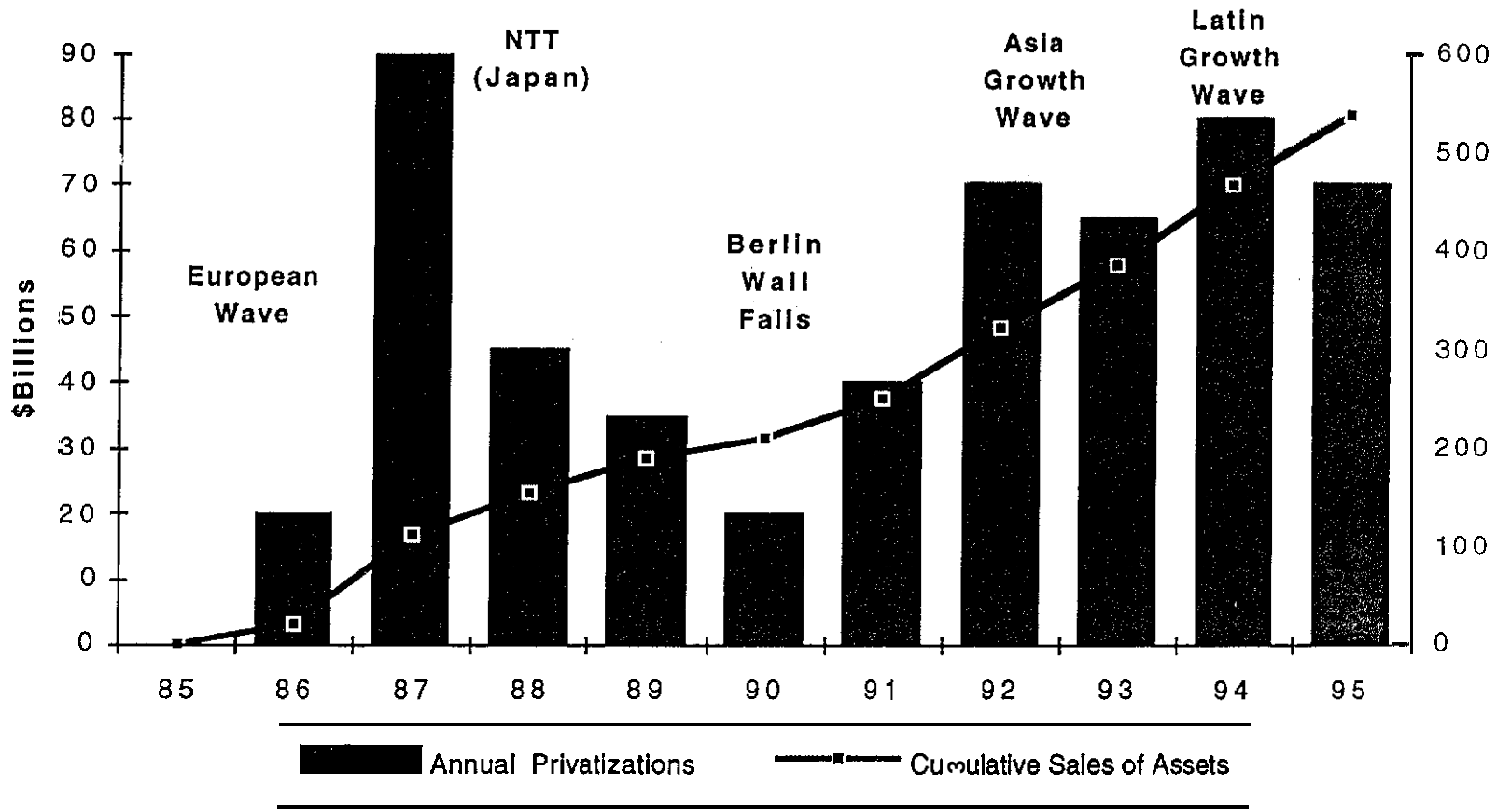
"Over" Developed Countries/OECD (continued)	**Rapidly Developing Countries** (continued)
Extensive regulation	Little environmental regulation
Well-developed roadways	Poor transportation systems
Crumbling infrastructure	New infrastructure
Reliable water supply (?)	Variable water supply (drought, flood)
Water is paid for and treated	Water is free and polluted
Large, intensive farming	Smaller agricultural crops

"Top Ten" Myths/Mistakes of Americans Doing Business in Latin America

- ⋆ The Latin American market is too risky to make any money on projects; Let's Wait!
- ⋆ All the Latin countries are similar — "One big bag of potatoes."
- ⋆ Our technical and management expertise is superior to the local talent.
- ⋆ "Let's send one of our engineers, José, to Brazil. He speaks Spanish."
- ⋆ American engineering capability is superior to the local engineering talent.
- ⋆ American designs, say for water treatment, can be easily adapted to Latin American conditions.
- ⋆ Wait until financing is already in place or assured before moving on projects.
- ⋆ Because of the riskier environment, the competition is not as intense.
- ⋆ Foreign competitors — Japanese and Europeans — are not well-positioned here.
- ⋆ Local stakeholders are not critical because decisions are made by the government.

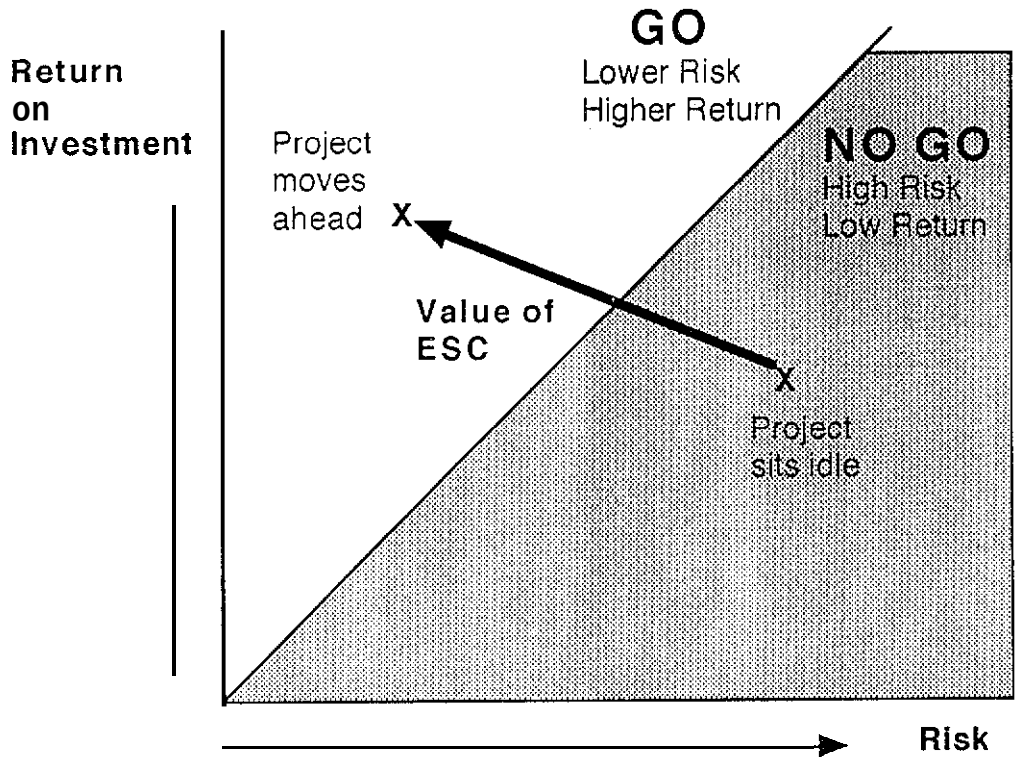
Major Events Lead to Global Waves of Privatization

Leading sectors: power, telecommunications, energy, banking, transport



ESC Potential Impact on Site Redevelopment

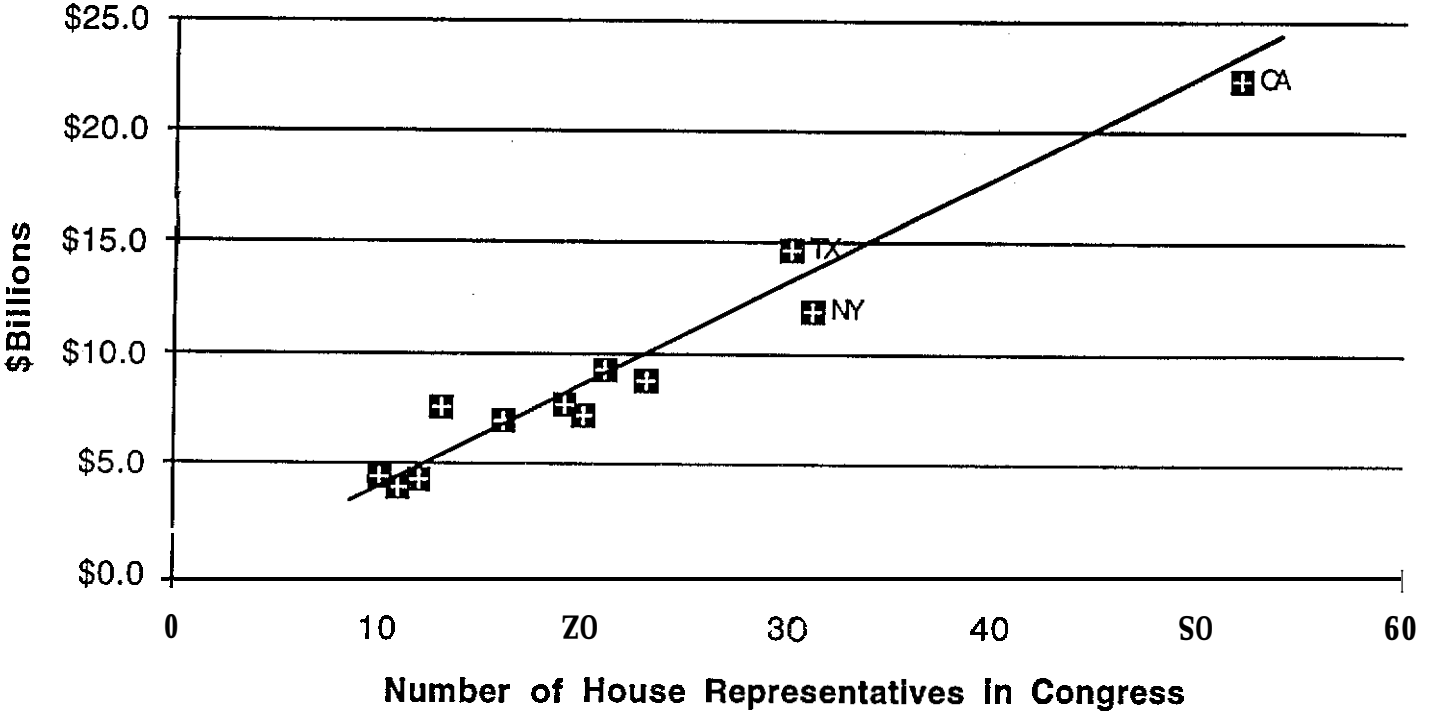
By reducing risk and enhancing return, ESC can move complex sites ahead



Investors always weigh risk vs. ROI in evaluating investment

Environmental Market in 13 Most Populus States

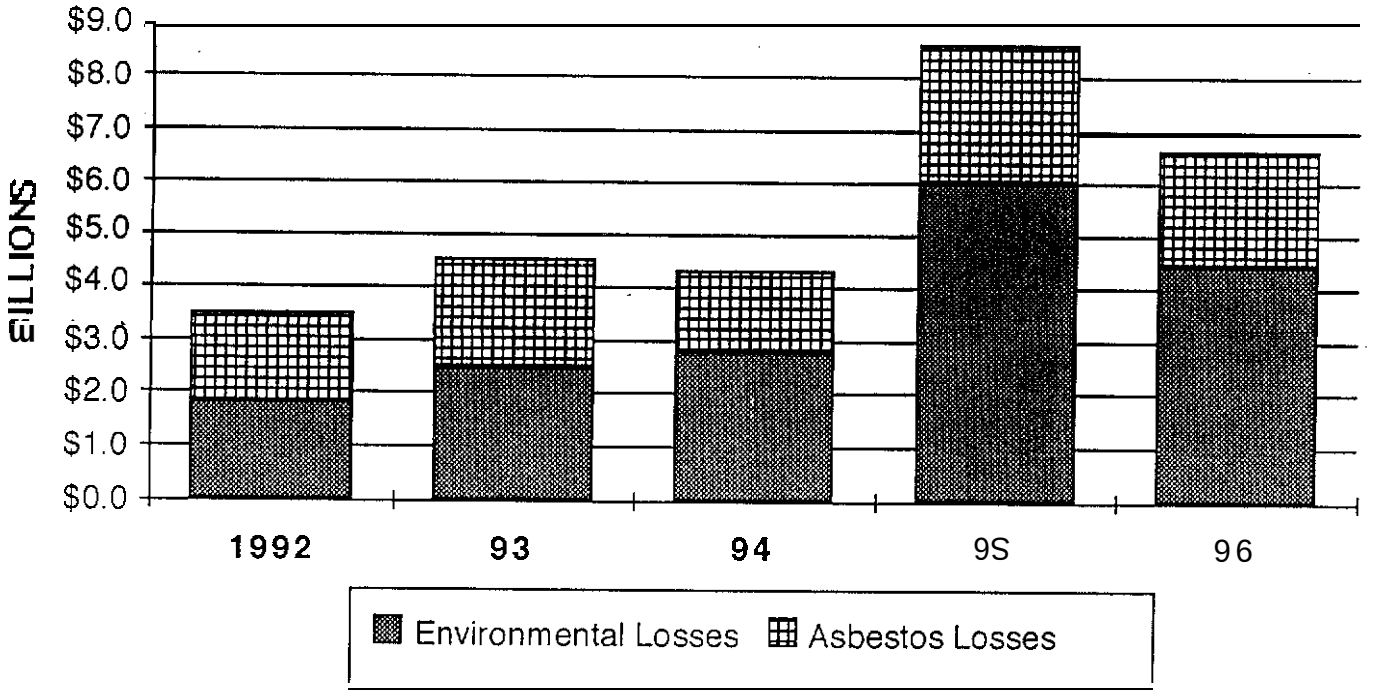
Environmental Revenues vs. House Members (1996)



Environmental Revenues by state are strongly correlated with size of House membership

Environmental Losses Incurred by Insurance f irms 1992-96

Top 40 incur 80% of the losses; NAIC forces reserve disclosure in 1995 in "Footnote 24"

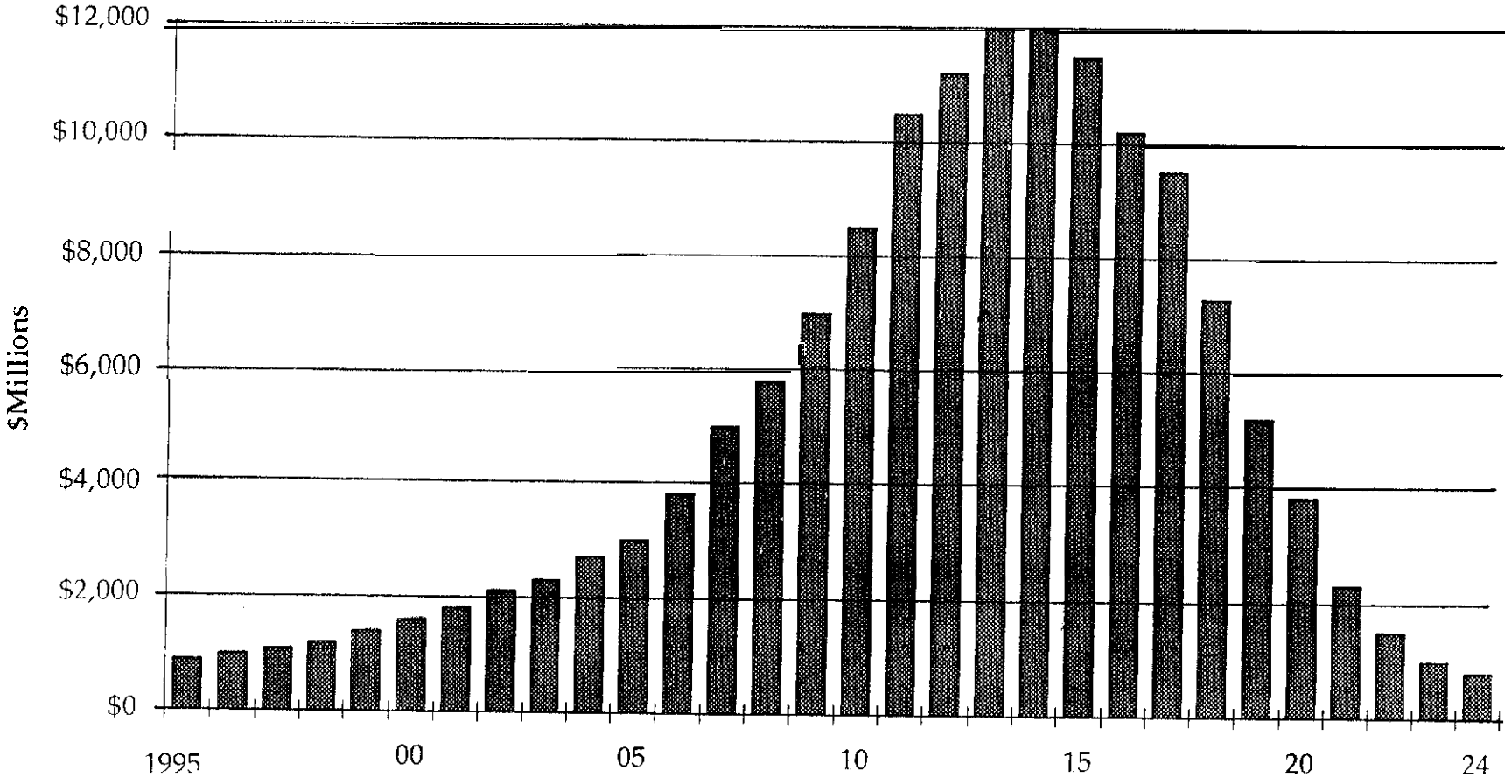


	753-a	93	94	95	96
Environmental Losses	$1.8	$2.5	$2.8	$6.0	$4.4
Asbestos Losses	$1.7	$2.0	$1.5	$2.6	$2.2
TOTAL ($Billions)	$3.5	$4.5	$4.3	$8.6	$6.6

The Problem: Environmental Liability Rises for Insurers

S&P Projection of Cleanup Costs for Insurance Firms tops $125 billion

Estimates based on average claims paid, sites remaining, market share. Projections are that insurance industry will reimburse 70-75% of private costs.



Remediation Spending 1990 - 2000

DOE & DOD spending slowly rises; Private cleanups subsided in 1994-95
Market can slowly recover with economic growth, but competition intensifies

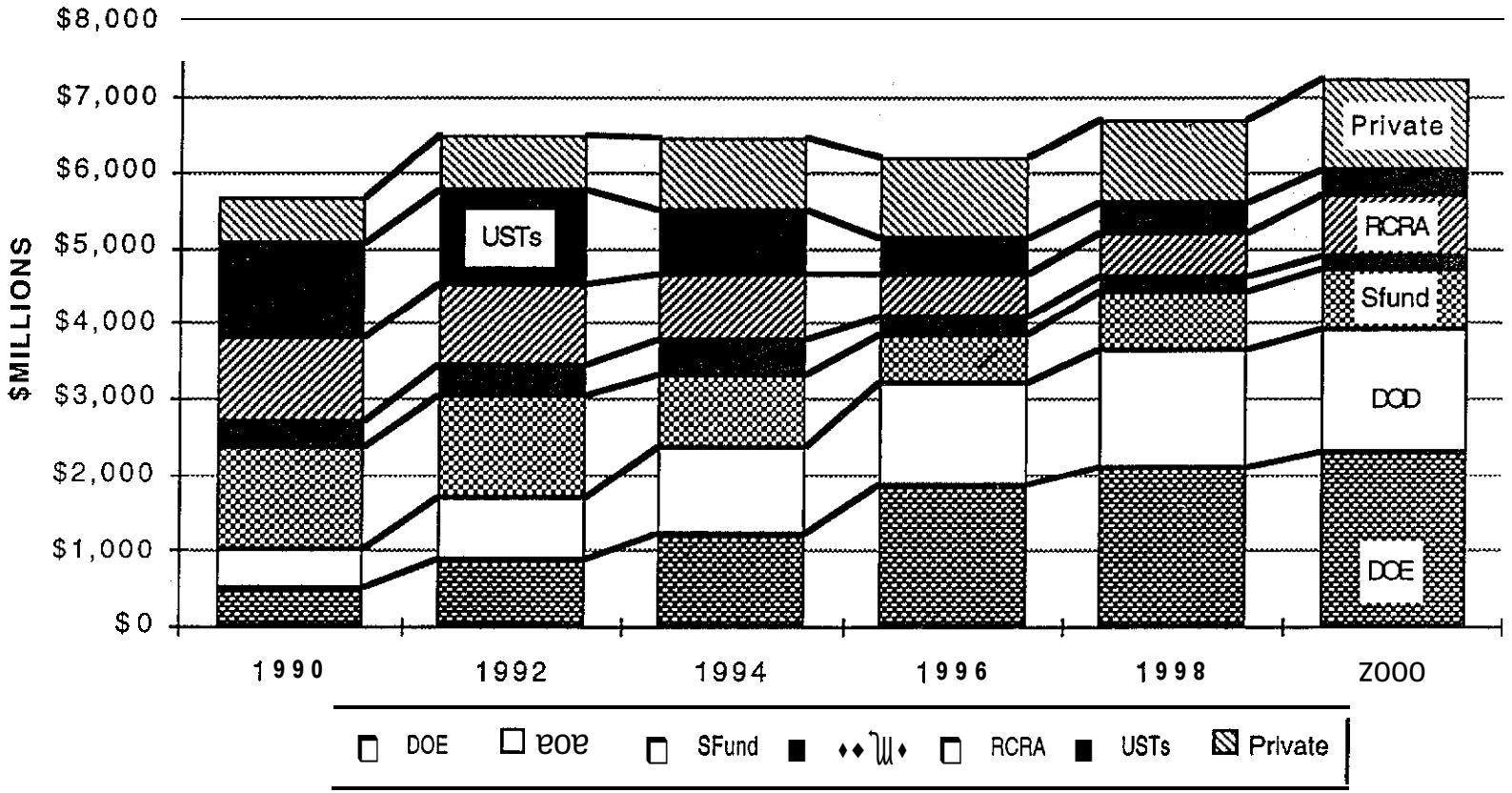
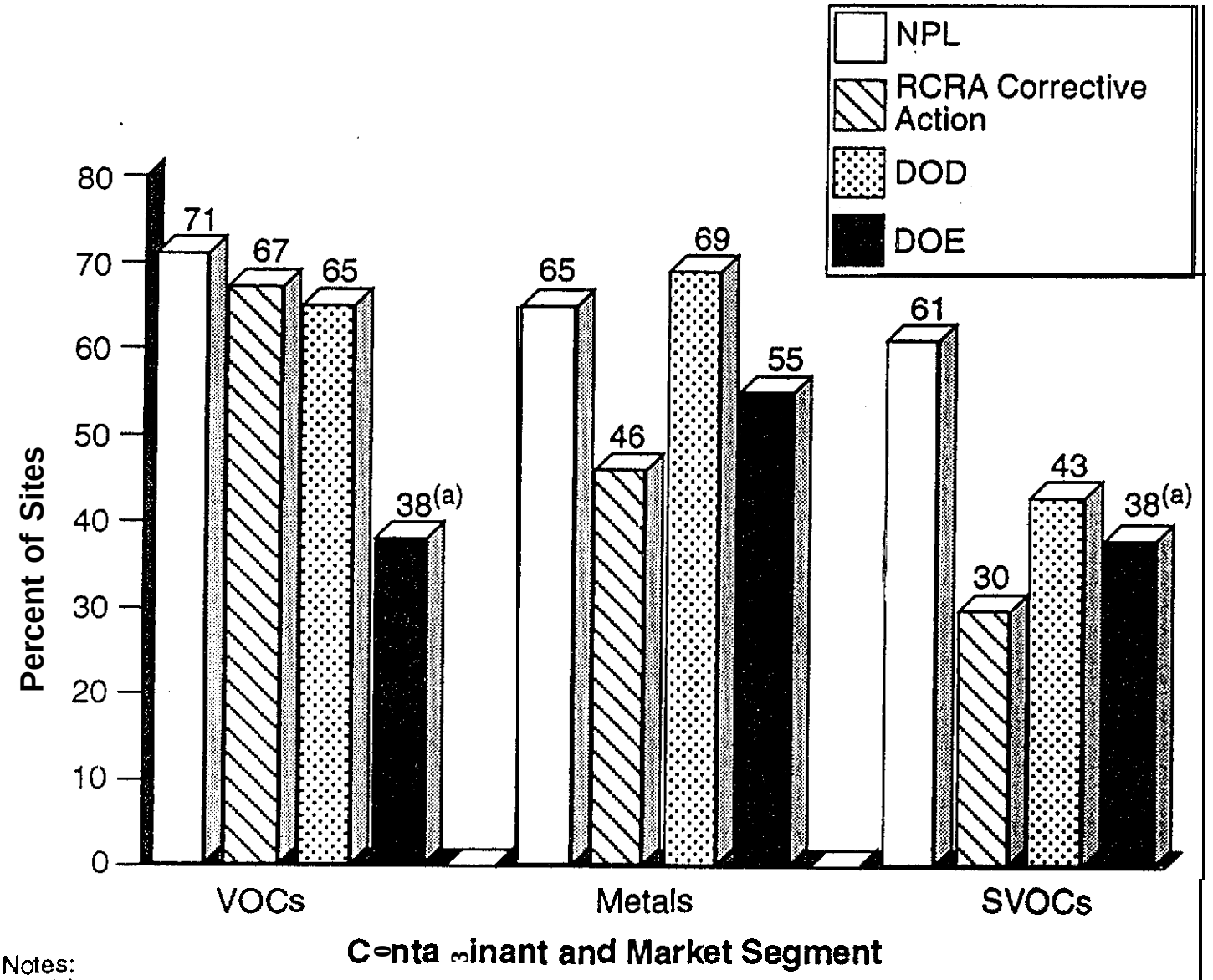


Exhibit 4: Contaminants to be Remediated



Notes:

- (a)DOE figures for VOCs and SVOCs are combined.
- 22% of the DOD sites contain fuels, 8% explosives, and 1% radioactive contaminants; 90% of the DOE installations contain radioactive elements.
- The datasets from which these percentages are estimated are explained in the text.

Almost all of the market sectors have substantial numbers of sites with metals and VOCs.